REQUEST FOR FILING A PATENT APPLICATION UNDER 37 C.F.R. §1.53(b)

Attorney Docket: 132/42381C2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This is a request for filing a __x__ continuation or ____ divisional application under 37 C.F.R. 1.53(b), of pending prior application:

Serial No. 08/895,687
Filed on July 17, 1997
Of Lawrence Robert Grzyll et al.
Entitled: Fire Extinguishing Meethods and Blends Utilizing Unsaturated Perfluorocarbons
Examiner: J. Anthony
Group: 1721
Batch No: _____

__X__ 1. Accompanying this order is a true copy of the prior application as originally filed.

_____ 2. New Formal drawings are being filed herewith consisting of _____ sheet(s), depicting Figures _____.

__X__ 3. Declaration and Power of Attorney:

a. ____ Newly executed (original or copy)

b. __X__ Copy from prior application

i. ____ Deletion of Inventors - signed statement attached deleting inventor(s) named in the prior application

__X__ 4. Incorporation by Reference:

The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 3b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

__X__ 5. Cancel original claims 8-13 and 27-33.

__X__ 6. Small entity status:

a. ____ A small entity statement is enclosed

b. __X__ A statement of small entity status was (copy attached) filed on August 25, 1995 in the prior application and status as a small entity is still proper and desired.

c. ____ Is no longer claimed

__X__ 7. The filing fee is calculated below:

CLAIMS AS FILED, INCLUDING ANY CLAIMS CANCELLED OR ADDED BY PRELIMINARY AMENDMENT

Basic Fee				$ 345.00
Total Claims	__6__ - 20 =	__0__	x 9 =	$_____
Ind. Claims	__2__ - 3 =	__0__	x 39 =	$_____
_____ Multiple Dependent Claims			+ 130 =	$_____
		Total		$ 345.00

_____ 8. Please charge my Deposit Account No. 05-1323 (Docket #_____) in the amount of $_____.

__X__ 9. A check in the amount of $ 345.00 to cover the filing fee is enclosed.

__X__ 10. The Commissioner is authorized to charge any fee which may be required under 37 CFR 1.16 or 37 CFR 1.17 or credit any overpayment to Deposit Account No. 05-1323 (Docket #132/42381CO).

__X__ 11. Amend the specification by inserting before the first line the sentence: --This application is a continuation of application Serial No. 08/895,687, filed July 27, 1997 which is a continuation of 08/519,809 filed on August 25, 1995.--

_____ 12. Priority of Appln. No(s). _____, filed in ___ on _____, is hereby claimed under 35 U.S.C. 119.

_____ 13. A certified copy of each said priority document was filed in application Serial No. _____ on _____.

__X__ 14. The prior application is assigned of record to Mainstream Engineering Corporation.

X 15. The power of attorney in the prior application is to:

Herbert I. Cantor, Reg. No. 24,392; James F. McKeown, Reg. No. 25,406; Donald D. Evenson, Reg. No. 26,160; Joseph D. Evans, Reg. No. 26,269; Gary R. Edwards, Reg. No. 31,824; Jeffrey D. Sanok, Reg. No. 32,169

X a. The power appears in the original application papers in the prior application.

_____ b. Since the power does not appear in the original application papers, a copy of the power in the prior application is enclosed.

_____ c. Attached a duplicate of Declaration which was filed in the prior application to overcome informalities.

X d. Address all future correspondence to:

EVENSON, McKEOWN, EDWARDS
& LENAHAN, P.L.L.C.
1200 G Street, N.W.
Suite 700
Washington, DC 20005

X 16. Forms PTO-892 and PTO-1449 listing prior art made of record in the prior application are attached. A copy of each of the listed references should be available in the prior application file.

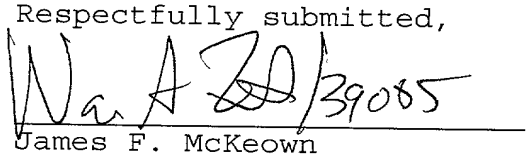
X 17. A Preliminary Amendment is being filed herewith.

X 18. Return Receipt Postcard.

_____ 19. Other: _____

Respectfully submitted,

February 9, 2000



James F. McKeown
Registration No. 25,406

EVENSON, McKEOWN, EDWARDS
& LENAHAN, P.L.L.C.
1200 G Street, N.W., Suite 700
Washington, D.C. 20005
Tel: (202) 628-8800
Fax: (202) 628-8844
JFM:WAZ:atc

Attorney Docket: 132/42381
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Lawrence Robert GRZYLL et al.

Serial No.: Not Yet Assigned

Filed: August 25, 1995

Title: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

SUBMISSION OF SMALL ENTITY DECLARATION

Box PATENT APPLICATION August 25, 1995
Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Small entity status is hereby claimed for the above-identified application. Submitted herewith is the appropriate Small Entity Declaration.

Respectfully submitted,

James F. McKeown
Registration No. 25,406

EVENSON, McKEOWN, EDWARDS
& LENAHAN
1200 G Street, N.W., Suite 700
Washington, DC 20005
Telephone No.: (202) 628-8800
Facsimile No.: (202) 628-8844

JFM/ats

Applicants or Patentee: Lawrence Robert GRZYLL, Dwight Douglas BACK, Charlie RAMOS and Nidal Abdul SAMAD

Serial or Patent No.: _____ Attorney's Docket No.: 132/42381

Filed or Issued: Even date herewith

For: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) AND 1.27(d) - SMALL BUSINESS CONCERN

I hereby declare that I am

[ ] the owner of the small business concern identified below:
[X] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Mainstream Engineering Corporation

ADDRESS OF CONCERN: 200 Yellow Place, Rockledge, FL 32955

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS by inventor(s) Lawrence Robert GRZYLL, Dwight Douglas BACK, Charlie RAMOS and Nidal Abdul SAMAD described in

[X] the specification filed herewith.
[ ] Application Serial No.: _____, filed _____
[ ] Patent No.: _____, issued: _____

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below*, and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as

a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entitles. (37 CFR 1.27).

NAME: _____

ADDRESS: _____

[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

NAME: _____

ADDRESS: _____

[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Robert P. Scaringe

TITLE OF PERSON OTHER THAN OWNER: President

ADDRESS OF PERSON SIGNING: 200 Yellow Place, Rockledge, Florida 32955

SIGNATURE: _____ DATE: _____

Attorney Docket: 132/42381C2
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: LAWRENCE R. GRZYLL ET AL.

Serial No.: Group Art Unit: 1721

Filed: February 9, 2000 Examiner: J. ANTHONY

Title: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

PRELIMINARY AMENDMENT

Box Non-Fee Amendment
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please enter the following amendments to the claims and prior to the examination of the application.

IN THE CLAIMS:

Please cancel Claim 33, without prejudice to or disclaimer or the subject matter therein.

Please add new Claims 34-39 as follows:

--34. A method of extinguishing a fire, comprising:

introducing a fire extinguishing composition comprising a mixture of an unsaturated perfluorocarbon and at least one additional fire extinguishing agent to the fire; and

maintaining a concentration of the fire extinguishing composition sufficient to extinguish the fire.

35. A method according to Claim 34, wherein said unsaturated perfluorocarbon is selected from the group

consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

36. A method according to Claim 34, wherein said additional fire extinguishing agent is selected from the group consisting of CF_3CFHCF_3, CF_3CF_2H, $CF_3CHFCHF_2$, and $CF_3CH_2CF_3$.

37. A method of extinguishing a fire, comprising introducing a fire extinguishing composition comprising a mixture of octafluoro-2-butene and at least one additional fire extinguishing agent to the fire; and

maintaining a concentration of the fire extinguishing composition sufficient to extinguish the fire.

38. A method according to Claim 34, wherein said additional fire extinguishing agent is a gas.

39. The method of Claim 34, wherein the step of introducing comprises streaming.--

REMARKS

Claims 34-39 are pending herein. By this Amendment, Claim 33 is canceled, and new Claims 34-39 are added. Entry of the amendments to the claims before examination of the application is respectfully requested.

If there are any questions regarding this Preliminary Amendment or this application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

It is respectfully requested that, if necessary to effect a timely response, this paper be considered as a Petition for

an Extension of Time sufficient to effect a timely response and shortages in other fees, be charged, or any overpayment in fees be credited, to the Account of Evenson, McKeown, Edwards & Lenahan, P.L.L.C., Deposit Account No. 05-1323 (Docket #132/42381C2).

Respectfully submitted,

February 9, 2000

Warren A. Zitlau
Registration No. 39,085

James F. McKeown
Registration No. 25,406

EVENSON, McKEOWN, EDWARDS
& LENAHAN, P.L.L.C.
1200 G Street, N.W., Suite 700
Washington, DC 20005
Telephone No.: (202) 628-8800
Facsimile No.: (202) 628-8844

JFM:WAZ:hs

Attorney Docket No. 132/42381
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

SPECIFICATION

INVENTION: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

INVENTOR: Lawrence Robert GRZYLL
Citizenship: U.S.A.
Postal Address/Residence: 1100 Typhoon Drive
Merritt Island, Florida 32953

INVENTOR: Dwight Douglas BACK
Citizenship: U.S.A.
Postal Address/Residence: 1372 Bonaventure Dr.
Melbourne, Florida 32940

INVENTOR: Charlie RAMOS
Citizenship: U.S.A.
Postal Address/Residence: 569 Verbinia Ct.
Satellite Beach, Florida 32937

INVENTOR: Nidal Abdul SAMAD
Citizenship: Lebanon
Postal Address/Residence: 1470 Malibu Circle, NE, Apt. 108
Palm Bay, Florida 32905

ATTORNEYS: EVENSON, McKEOWN, EDWARDS & LENAHAN
Suite 700
1200 G Street, N.W
Washington, D.C. 20005
Phone No.: (202) 628-8800
Facsimile No.: (202) 628-8844

FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to fire extinguishing methods and blends utilizing unsaturated C_3 and C_4 perfluorocarbons.

The use of halogenated chemical agents containing combinations of fluorine, chlorine, bromine, iodine, and hydrogen is well-known. The most common of these agents are Halon 1301 (CF_3Br), Halon 1211 (CF_2ClBr), and Halon 2402 (CF_2BrCF_2Br). These three agents are thought to be effective at fire extinguishment because they decompose in the fire and interfere with the normal chain reactions of the fire combustion process (i.e. they are chain terminators).

Known extinguishing agents also possess the volatility that makes them useful for total flooding applications or streaming applications in portable fire extinguishers. They are clean agents; this means that they leave no residue upon evaporation or during fire suppression. They also nonreactive to the majority of metals and nonmetals with which they come into contact with during use. They are also safe agents, having toxicity characteristics suitable for occupied spaces during their use.

These three agents are, however, believed to be capable of destroying the ozone layer. Hence, their manufacture has been banned by recent environmental regulations. They are also thought to contribute to global warming because their atmospheric lifetime is sufficiently long that they persist in the atmosphere and absorb solar radiation.

In an effort to solve this problem, U.S. Patent No. 5,124,053 describes the use of saturated, higher fluorinated hydrofluorocabons and blends thereof with other agents for use in fire extinguishing methods and apparatus. Specifically, the use of saturated C_2 or C_3 higher fluorinated hydrocarbons of the formula $C_xH_yF_z$, where x is 2 or 3, y is 1 or 2, and z is 5, 6, or 7: where y is 1 and z is 5 when x is 2 and where z is 6 or 7 when x is 3. Because these compounds contain no chlorine or bromine, they have zero ozone depletion potential. The compounds are also asserted to not pose a threat as greenhouse warming gases and also have toxicity characteristics suitable for use in occupied spaces.

It is an object of the present invention to provide a fire extinguishing method that extinguishes fires as effectively as the common Halons (i.e. Halons 1301 and 1211), has similar volatility, residue levels, materials compatibility characteristics, and safety characteristics, and yet is environmentally acceptable.

It is a further object of this invention to provide blends of unsaturated perfluorocarbons with other fire extinguishing agents that share the useful properties described above but are environmentally acceptable.

These objects have been achieved with the recognition that unsaturated C_3 and C_4 perfluorocarbons are effective fire extinguishing agents at concentrations similar to those of the well-known Halons. However, these materials have no chlorine or bromine, and thus, have zero ozone depletion potential.

We have also found that because these compounds are unsaturated (i.e., a double bond between two carbon atoms), they are much less stable and are susceptible to breakdown in the lower atmosphere, and thus do not pose a threat as a greenhouse warming gas.

Specific unsaturated perfluorocarbons which are useful include compounds of the formula C_xF_y, where x is 3 or 4 and y is 6 or 8, respectively. Specific unsaturated perfluorocarbons which are useful include hexafluoropropene ($CF_3CF=CF_2$), octafluoro-1-butene ($CF_2=CFCF_2CF_3$), and octafluoro-2-butene ($CF_3CF=CFCF_3$).

These compounds may be used alone, in mixture with one another, or in mixture with other fire extinguishing agents or gases. These agents may be applied using the standard

fire extinguishing application techniques and methods used for the standard Halons. These agents may be used in total flooding applications or systems where an entire enclosed region is subjected to the agent, or they may be used in portable fire extinguishing equipment. As will now be apparent to one skilled in the art, the agents may be pressurized with nitrogen or another inert gas to ensure adequate flow of the agent through the fire suppression system.

These agents should be used at a minimum concentration to effectively extinguish a fire. This exact concentration depends on several variables, including the exact agent or blend used, the combustion material, and the combustion of fire conditions and scenario. The best laboratory results have been found where the agent is employed at a concentration of at least 4% (v/v). The maximum concentration employed is determined, generally speaking, by economics and safety. Of course, in unoccupied areas, the maximum concentration may be increased because no living things are present.

DETAILED DESCRIPTION OF CURRENTLY PREFERRED EMBODIMENTS

The fire suppression effectiveness of octafluoro-2-butene and hexafluoropropene were demonstrated in a dynamic test using a glass cup burner apparatus and test procedure with n-hexane and air being supplied to the burner. Vapor

of the agent being tested was mixed with air and introduced to the flame. The concentration of the agent was slowly increased until the flame was extinguished; this is referred to as the flame extinguishing concentration. Table 1 provides a summary of the data for octafluoro-2-butene and hexafluoropropene and compares this data to the published values for the standard Halons and for some of the fire suppression agents described in U.S. Patent No. 5,124,053. Table 1 shows that, in terms of flame extinguishing concentration, the compounds of this invention are more effective agents than the compounds described in U.S. Patent No. 5,124,053 for n-heptane diffusion flames in the cup burner.

Table 1 - Extinguishment of n-Heptane Diffusion Flame

Agent	Air Flow	Agent Flow	Flame Ext. Conc.
octafluoro-2-butene[1]	20,050 cc/min	856 cc/min	4.0% (v/v)
hexafluoropropene[1]	13,480 cc/min	736 cc/min	5.2% (v/v)
CF_3CFHCF_3 [2]	16,200 cc/min	1,506 cc/min	9.3% (v/v)
CF_3CF_2H [2]	16,200 cc/min	1,033 cc/min	6.4% (v/v)
Halon 1301[3]	16,200 cc/min	510 cc/min	3.1% (v/v)
Halon 1211[3]	16,200 cc/min	546 cc/min	3.4% (v/v)

[1] indicates compounds of the present invention
[2] indicates compounds described in U.S. Patent No. 5,124,053
[3] standard commercial Halons

Should have superscript "1"

Table 2 - Stability Test Results

Fluid	Final Conc. (%)	Initial Conc. (%)	Percent change
Test Temperature = 300 C			
$CF_3CHFCHF_2$ [2]	99.26	99.29	0.03
CF_3CFHCF_3 [2]	99.67	100.00	0.33
$CF3CH_2CF3$ [2]	95.71	98.01	2.35
Octafluoro-2-butene[1]	96.48	98.99	2.51
Hexafluoropropene[1]	62.58	100.00	37.42
Test Temperature = 350 C			
$CF_3CHFCHF_2$ [2]	97.79	99.29	1.51
CF_3CFHCF_3 [2]	97.58	100.00	2.42
$CF3CH_2CF3$ [2]	88.64	98.01	9.56
Octafluoro-2-butene[1]	89.16	98.99	9.83
Hexafluoropropene[1]	5.50	100.00	94.50
Test Temperature = 400 C			
CF_3CFHCF_3 [2]	90.05	100.00	9.95
$CF3CH_2CF3$ [2]	75.24	98.01	23.23
$CF_3CHFCHF_2$ [2]	71.63	99.29	27.86
Octafluoro-2-butene[1]	66.56	98.99	32.43
Hexafluoropropene[1]	0.00	100.00	100.00

[1] indicates compounds of the invention
[2] indicates compounds in U.S. Patent No. 5,124,053
* octafluoro-2-butene has 2 isomers, the percent listed is the sum of both isomers

We have also been able to demonstrate that the compounds of the present invention are much less thermally stable than the compounds in U.S. Patent No. 5,124,053.

That is, the compounds of our invention are less of a threat of being greenhouse warming gases than those of U.S. Patent No. 5,124,053. To demonstrate this, we mixed the compound to be tested with air in a pressure cylinder to approximately 1.4% (v/v). This gas mixture was then passed over a 75 ml reactor packed with palladium (0.5% on 1/8" alumina pellets) catalyst which was immersed in a constant-temperature bath. This system provided a minimum residence time of 2.24 seconds when the initial mixture pressure was 100 psia. The mixture was collected after passing through the reactor and analyzed on a gas chromatograph for the presence and concentration of decomposition products. Table 2 compares the results at three reactor temperatures for compounds of the present invention and compounds in U.S. Patent No. 5,124,053 and shows that the former compounds are less thermally stable than the latter compounds, as shown by the higher values for "percent change" in Table 2. Thus, they would be less of a threat of being a greenhouse warming gas.

The residue level of octafluoro-2-butene and hexafluoropropene were experimentally measured using a method recommended by NIST (NIST Technical Note 1278). Namely, the measurement was performed by condensing about 1 cc of the agent in a crucible cooled in a dry ice/acetone bath. The crucible was cleaned and weighed prior to condensing the agent to be tested. Once the agent was transferred to the crucible, the agent was allowed to

slowly evaporate. The crucible is then heated in an oven at 105°C for 30 minutes and weighed again. The weight percent residue of the agent is then calculated from the weight of the crucible before and after the test. Octafluoro-2-butene was found to have 0.04% (w/w) residue, while hexafluoropropene was found to have 0.00% (w/w) residue. Both of these levels are acceptable for fire suppression agents (NIST Technical Note 1278).

The materials compatibility of octafluoro-2-butene and hexafluoropropene with metals and nonmetals were experimentally demonstrated and found to be acceptable. The test apparatus was a thick-walled glass pressure tube that has a glass thread at the top and a threaded plunger valve that allows for evacuating the tube and charging with another fluid under pressure. The tube was 17.8 cm in length and has an OD of 25.4 mm. The metals and nonmetals tested were Nitronic 40, copper CDA 172, aluminum 6061-T6, 1020 alloy steel, Teflon TFE, silicon rubber, Buna-N, and Viton. Circular coupons of these materials have been procured that measure 1/2" OD, 1/16" thick, with a 9/64" OD hole in the center. A Teflon rod passed through this hole and suspends the coupon, small Teflon spacers separate the coupons on the Teflon rod. Two coupons from each material are mounted on the Teflon rod and placed in the test container. The tube with the test samples is then evacuated and charged with candidate agent so that each of the test coupons is covered with liquid agent. The test

time has been set at one month, and the test temperature has been set at room temperature.

Each metal coupon is cleaned ultrasonically with acetone and isopropanol, dried, and weighed to the nearest 0.1 mg prior to mounting on the Teflon rod. After the test, the metal coupons are cleaned, examined under a microscope, and weighed to determine the corrosion rate according to the equation below.

$$corrosion\ rate\left(\frac{mil}{year}\right)=\frac{345x10^{6}(w_i-w_f)}{Atd}$$

where:

w_i = initial weight (g)

w_f = final weight (g)

A = area of coupon (in^2)

t = time (h)

D = metal density (g/ml)

The nonmetal samples are cleaned prior to the test in a soap/water solution, dried, and weighed to the nearest 0.1 mg prior to mounting on the Teflon rod. After the test, the nonmetal coupons are cleaned, examined under a microscope, and their dimensions are measured with a micrometer to determine if any swelling occurred.

Tables 3 and 4 present the results of these materials compatibility tests. The corrosion rates listed are average

values for the two metal samples of each material. The values with a "less-than" ("<") correspond to a mass change less than the sensitivity of our balance (± 0.1 mg). Table 4 presents the results of the materials compatibility tests for the nonmetal samples tested. A compatibility rating was defined based on the percentage change in the thickness of the sample before and after the test. Mass changes and diameter changes of the sample were also measured during the test, and were found to correlate highly with the change in sample thickness. Percent mass changes correlated to percent thickness changes by an average factor of 6.1 (R^2=0.96), percent diametric changes correlated to percent thickness changes by an average factor of 0.57 (R^2=0.92).

Table 3 - Corrosion Rates (mm/year x10^4)				
	1020 Steel	Al 6061-T6	Cu CDA 172	Nitronic 40
octafluoro-2-butene	48.4	106	184	96.9
hexafluoropropene	< 1.85	53.2	54.0	7.21

Table 4 - Materials Compatibility Results For Nonmetals				
	Buna-N	Silicon Rubber	Viton	Teflon
octafluoro-2-butene	B	C	B	A
hexafluoropropene	A	C	B	B

A: negligible effect (0-2% thickness change)

B: minor effect (2-5% thickness change)

C: moderate effect (5-15% thickness change)

D: severe effect (>15% thickness change and/or breakage)

The short-term toxicity characteristics of octafluoro-2-butene were also experimentally demonstrated. In this test, 10 rats were exposed to approximately 9% (v/v) of the agent, which is approximately twice the flame extinguishing

concentration in the cup burner. The exposure time was 15 minutes, plus a 23-minute time for the chamber concentration to reach equilibrium. This time is well in excess of the time required to evacuate a room or other enclosed facility where an agent is dispersed to fight a fire. After the exposure period, each of the animals was returned to the cage and observed for 14 days. All animals survived the exposure to the test atmosphere. This test showed that the 15-minute lethal concentration (LC_{50}) of this agent is greater than 9% (v/v).

Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example, and is not to be taken by way of limitation. The spirit and scope of the present invention are to be limited only by the terms of the appended claims.

WHAT IS CLAIMED IS:

1. A method of extinguishing a fire, comprising the steps of

introducing to the fire a fire extinguishing composition consisting of at least one unsaturated perfluorocarbon compound having the formula

C_xF_y

where x is 3 or 4 and y is 6 or 8, respectively,

and maintaining the concentration until the fire is extinguished.

2. The method of claim 1, wherein the perfluorocarbon is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

3. The method of claim 1, wherein the composition is a mixture of at least two unsaturated perfluorocarbons.

4. The method of claim 3, wherein each of the perfluorocarbons is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

5. The method of claim 1, wherein the composition includes a mixture of conventional fire extinguishing agents.

6. The method of claim 5, wherein the perfluorocarbon is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

7. The method of claim 1, wherein the composition has a concentration level of at least about 4% (v/v).

8. The method of claim 1, wherein the step of introducing comprises total flooding.

9. The method of claim 1, wherein the step of introducing occurs in an enclosed region.

10. The method of claim 1, wherein the step of introducing includes using an inert gas to pressurize the composition sufficiently to maintain an adequate flow of the composition toward the fire.

11. The method of claim 1, wherein the composition has low thermal stability.

12. The method of claim 1, wherein the perfluorocarbon compound has a residue of no more than about 1.00% (w/w).

13. The method of claim 1, wherein the perfluorocarbon compound is compatible with metals and nonmetals.

14. The method of claim 1, wherein the perfluorocarbon compound does not exhibit short-term toxicity.

15. The method of claim 4, wherein the composition has a concentration level of at least about 4% (v/v).

16. The method of claim 15, wherein the step of introducing includes using an inert gas to pressurize the composition sufficiently to maintain an adequate flow of the composition toward the fire.

17. The method of claim 1, wherein the step of introducing includes providing the composition in a portable fire extinguisher.

18. The method of claim 17, wherein the perfluorocarbon is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

19. The method of claim 18, wherein the step of introducing includes using an inert gas to pressurize the composition sufficiently to maintain an adequate flow of the composition toward the fire.

20. The method of claim 18, wherein the perfluorocarbon compound has a residue of no more than about 1.00% (w/w).

21. A method of using at least one unsaturated perfluorocarbon having the formula C_xF_y, where x is 3 or 4 and y is 6 or 8, respectively, for extinguishing fires.

22. The method of claim 21, wherein the perfluorocarbon is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

23. A composition consisting of at least one unsaturated perfluorocarbon having the formula C_xF_y, where x is 3 or 4 and y is 6 or 8, respectively, at a concentration level sufficient to extinguish a fire.

24. The method of claim 23, wherein the perfluorocarbon is selected from the group consisting of hexafluoropropene, octafluoro-1-butene, and octafluoro-2-butene.

25. The composition according to claim 23, wherein the concentration level is at least about 4% (v/v).

26. The composition according to claim 23, wherein the perfluorocarbon compound has a residue of no more than about 1.00% (w/w).

ABSTRACT

Unsaturated C_3 and C_4 perfluorocarbons are used to extinguish fires. These compounds have been found to extinguish fires as effectively as Halons with similar volatility, residue levels, materials compatibility and safety but with enhanced environmental acceptability.

ATTORNEY DOCKET NO.: 132/42381
PATENT

DECLARATION AND POWER OF ATTORNEY - PATENT APPLICATION

As a below named inventor, I hereby declare that my citizenship, postal address and residence are as stated below; that I verily believe I am the original, first and sole inventor (if only one inventor is named below) or a joint inventor (if plural inventors are named below) of the invention entitled:

FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

the specification of which

_X_ is attached hereto, or

____ was filed on _____ as Application Serial No. _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to be material to patentability as defined in 37 CFR §1.56. I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year)	___
_____ (Number)	_____ (Country)	_____ (Day/Month/Year)	___

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information known to be material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status)

I hereby appoint as principal attorneys Herbert I. Cantor, Reg. No. 24,392; James F. McKeown, Reg. No. 25,406; Donald D. Evenson, Reg. No. 26,160; Joseph D. Evans, Reg. No. 26,269; Gary R. Edwards, Reg. No. 31,824; Jeffrey D. Sanok, Reg. No. 32,169; and Corinne M. Pouliquen, Reg. No. 35,753, to prosecute and transact all business in the Patent and Trademark Office connected with this application and any related United States and international applications. Please direct all communications to:

Evenson, McKeown, Edwards & Lenahan
1200 G Street, N.W., Suite 700
Washington, D.C. 20005
Telephone: (202) 628-8800
Facsimile: (202) 628-8844

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code. and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

INVENTOR: Lawrence Robert GRZYLL
Citizenship: U.S.A.
Postal Address/Residence: 1100 Typhoon Drive
Merritt Island, Florida 32953

8/24/95
Date

Signature

INVENTOR: Dwight Douglas BACK
Citizenship: U.S.A.
Postal Address/Residence: 1372 Bonaventure Dr.
Melbourne, Florida 32940

08/24/95
Date

Signature

INVENTOR: Charlie RAMOS
Citizenship: U.S.A.
Postal Address/Residence: 569 Verbinia Ct.
Satellite Beach, Florida 32937

8/24/95
Date

Signature

INVENTOR: Nidal Abdul SAMAD
Citizenship: Lebanon
Postal Address/Residence: 1470 Malibu Circle, NE, Apt. 108
Palm Bay, Florida 32905

8/24/95
Date

NIDAL
Signature